Space Weather Technical Forecast

Issued on Monday, 27 June 2022 at 13:20 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Active electron fluence likely from day 2 (28th). Slight chance of G1 Minor geomagnetic storms on day 1 (27th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has remained Low over the past 24 hours, with several small C-class flares. There are two active regions on the visible disk. AR3038 has rotated off the west limb but a new region, AR3041, emerged to the east of it. This region appears weak and stable bi-polar. AR3040 Cao/Beta in the southern hemisphere, has just rotated into the western hemisphere and remains small and simple. This has been the source region for the most recent low level C-class flares.
There are considered to be no new Earth-directed CMEs showing on available imagery. The lack of SDO data means confidence is low and there remains the possibility of a weak transient feature embedded in the solar wind.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured at L1, remains elevated around 550 km/s at present. Density mostly at average, or just above average, levels. The Phi angle was predominately negative (towards the Sun). The total Interplanetary Magnetic Field (IMF) was mostly weak near 6nT. The North-South component of the IMF, Bz, fluctuated between negative and positive values, in the range -7/+7 nT. Geomagnetic activity was Quiet to Active (Kp 2 to 4).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) as measured by GOES16 remained at Background levels through the period. High energy electron flux (greater than 2MeV) rose from High levels at 27/0750 UTC, with a peak of 2930 pfu observed at 27/1115 UTC. The corresponding 24-hour electron fluence remained below the Active threshold (1e8 integrated pfu) but with a rising trend. An observed fluence of 2.51e7 integrated pfu at 27/0000 UTC.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Low to very Low, with only a slight chance of increasing to Moderate with any M-flares that occur.

Solar Wind / Geomagnetic Activity: The CME from the 24th is expected to miss, passing just ahead, but may give a glancing blow early on day 2 (28th). Solar winds are expected to remain enhanced on day 1 (27th) due to ongoing coronal hole influence from CH95/-, with further possible influence from CH93/- and CH94/-, before gradually easing on day 2 (28th). Geomagnetic activity is likely to be mainly Unsettled with Active intervals and a slight chance of G1/Minor Storms on day 1 (27th). This gradually easing to Quiet with Unsettled spells and a slight chance of Active intervals from later on day 2 (28th), and likely becoming mostly Quiet by day 4 (30th). Perhaps a temporary increase again to Unsettled to Active with any glancing CME interaction early day 2 (28th), however this is a very low risk.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10 MeV) is expected to remain at Background, with only a very slight chance of rising above this level as AR3038 rotates around the northwest limb. The high energy electron flux (greater than 2 MeV) are expected to peak diurnally at High levels. Any CME glance that occurs early on day 2 (28th) may lead to a drop out in values, however this is very low confidence. Corresponding electron fluence is expected to continue its renewed rising trend, with Active (1e8 integrated pfu) fluence likely from day 2 (28th).

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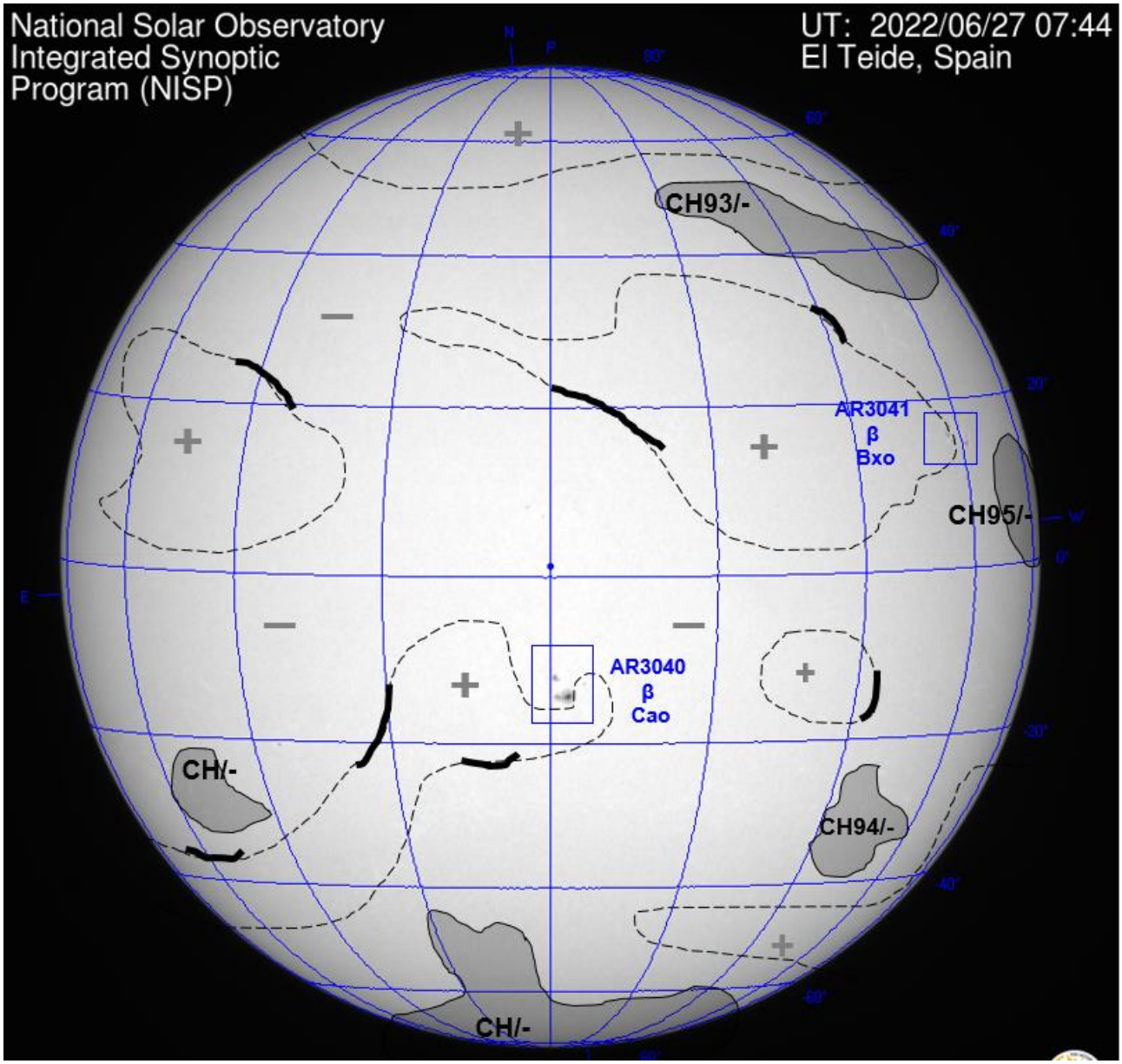
Figure 1. Solar Analysis Valid 27/0800 UTC.



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SDO imagery not available. GOES16 SUVI and GONG data used.

Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no significant CMEs on the Earth-Sun line, however a filament eruption on the 24th produced a weak CME that was visible on STEREO A cor2 imagery. This has been assessed as passing just ahead of Earth, but may give a glancing interaction early on day 2 (28th), although this assessment is low confidence due to the lack of significant CME signal on SOHO coronagraphs.

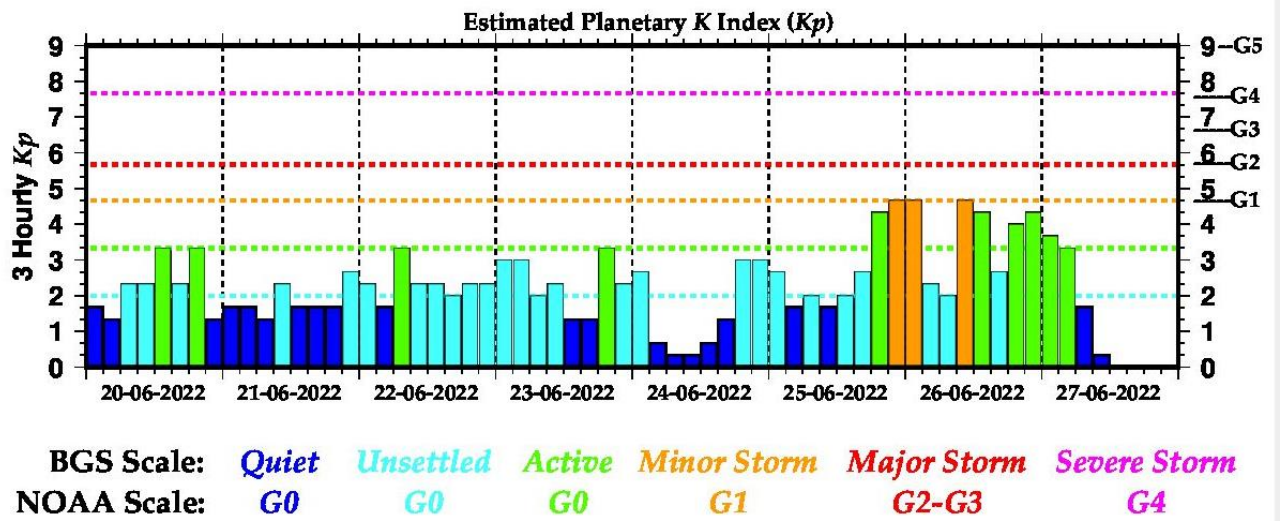
Current solar wind conditions observed at L1 suggest Earth has connected to the High Speed Stream from CH95/-. Ongoing solar wind enhancement is expected on day 1 (27th) with possible influence also from CH93/- and CH94/- slowly easing from day 2 (28th).

Geomagnetic activity is likely to be mainly Unsettled with Active intervals, and a slight chance of G1/Minor Storms at first. This gradually easing to Quiet with Unsettled spells and a slight chance of Active intervals from day 2 (28th), and likely becoming mostly Quiet by day 4 (30th). Perhaps a temporary increase again to Unsettled to Active with any glancing CME interaction early day 2 (28th), however this is a very low risk.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	10	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections - Nil

Figure 2: BGS Kp index.


Estimated Planetary K Index (Kp)
3 Hourly Kp
9 8 7 6 5 4 3 2 1 0
G5 G4 G3 G2 G1
20-06-2022 21-06-2022 22-06-2022 23-06-2022 24-06-2022 25-06-2022 26-06-2022 27-06-2022
BGS Scale: Quiet Unsettled Active Minor Storm Major Storm Severe Storm
NOAA Scale: G0 G0 G0 G1 G2-G3 G4

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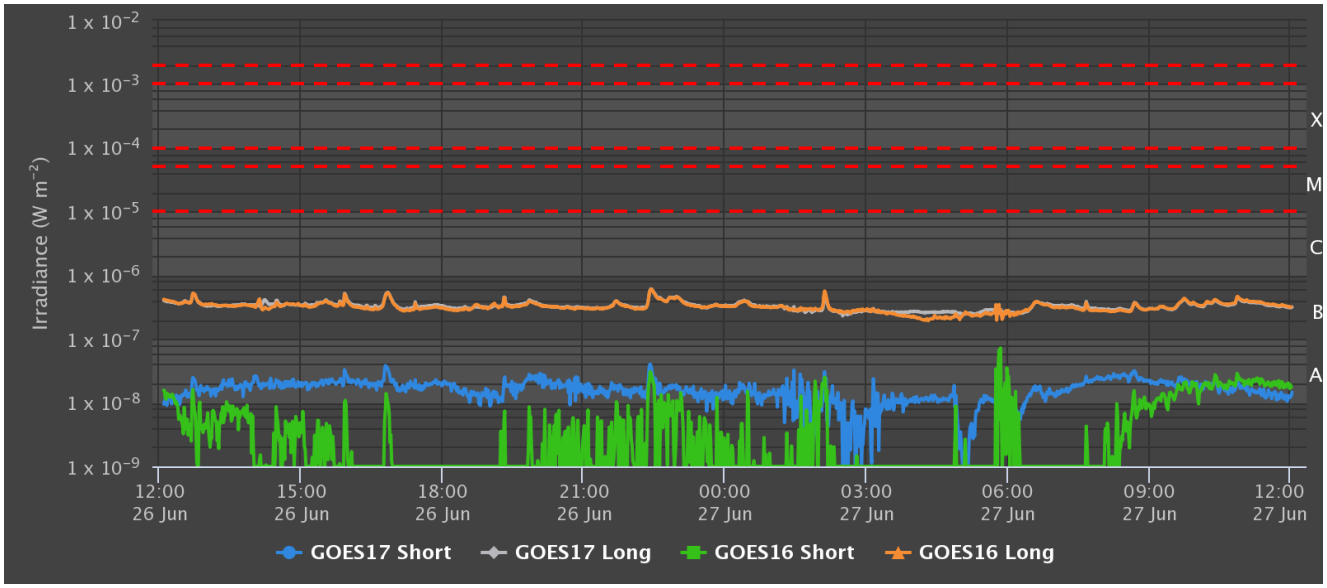
Radio Blackouts - X-Ray Flares:
There are currently two active regions on the visible disc. AR3038 (Eso/Beta) has rotated around the northwest limb, however a new numbered region has emerged just to the east. AR3041 appears relatively stable, with a simple magnetic configuration. AR3040 (Cao/Beta) in the southern hemisphere, has moved into the western hemisphere and remains small and simple. This has been the source region for the most recent low level C-class flares.
Solar activity has remained Low with several small C-flares in the last 24 hours, and is expected to persist either at Low or Very Low throughout. There is a slight chance of isolated Moderate flares.
(Please note, SDO imagery is currently unavailable leading to a lack of high-resolution imagery for analysis. Consequently the current solar assessment is based primarily on GONG imagery supported by imagery from GOES SUVI).

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	10	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3:GOES16 X-Ray flares very Low



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels, and will most likely remain at this level through the period. There is a very slight chance of proton levels rising above background should any notable flare occur from AR3038 due to its location, now rotating around the northwest limb.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux, as observed by GOES-16, returned to High levels from 27/0750UTC.
Flux levels are expected to peak diurnally at High levels. Any CME glance that occurs early on day 2 (28th) may lead to a drop out in values, however this is very low confidence.
The associated 24 hour fluence is below the Active level at first, but rising with a likelihood of breaching the Active (1e8) threshold later day 1 (27th), similar to the previous rotation, but around 24 hours later than a standard 27-day persistence would suggest. REFM now indicates a similar increasing trend, and is considered good advice.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	60	60	60	70
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	5	10	10

Figure 4: MOSWOC REFM shows fluence likely to breach Active threshold later today.

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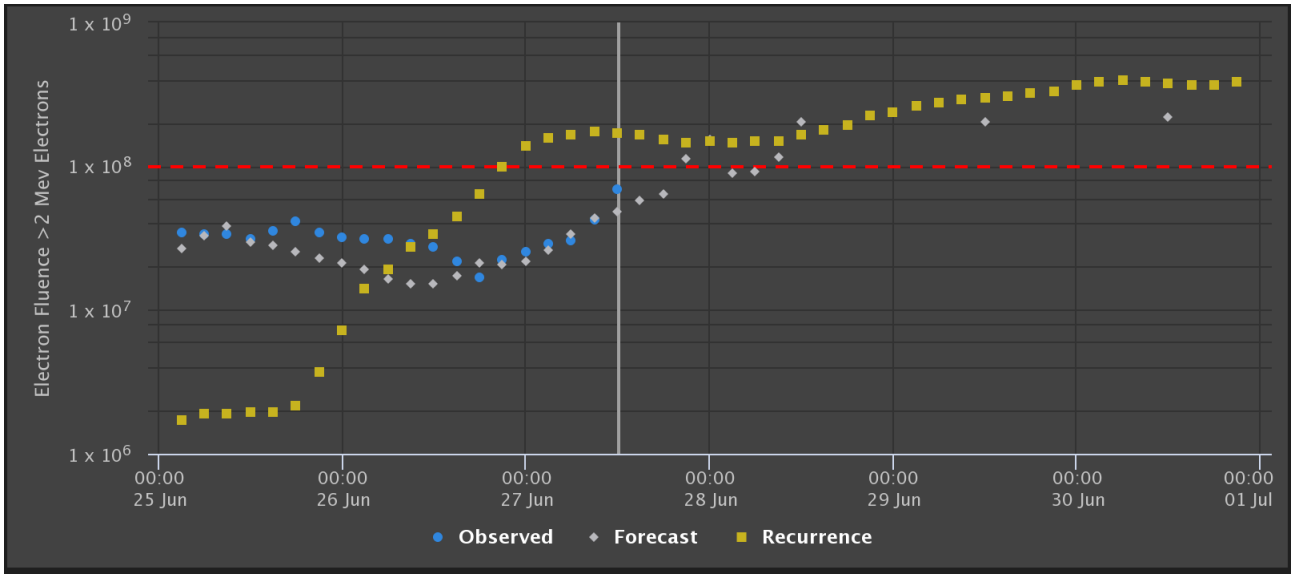

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